

$$f(x) = \sqrt{x-3} \quad g(x) = \frac{1}{x+2}$$

- ① Find the domain of $f(x)$ and $g(x)$ algebraically.
- ② Find the equations for $(f \circ g)(x)$ and $(g \circ f)(x)$ and their domains.
- ③ Find $f^{-1}(x)$ and $g^{-1}(x)$.
- ④ Find the difference quotient, $\frac{f(x+h)-f(x)}{h}$, for $f(x) = 3x+5$.

$$f(x) = \sqrt{x-3}$$

$$g(x) = \frac{1}{x+2}$$

boundary

$$x-3=0$$

$$x=3$$

boundary



$$3 \leq x$$

Point(s)

$$x+2=0$$

$$x=-2$$

$$\text{All } \mathbb{R}, x \neq -2$$

$$f(x) = \sqrt{x-3}$$

$$g(x) = \frac{1}{x+2}$$

$$(f \circ g)(x)$$

$$\begin{aligned} x+2 &= 0 \\ x &= -2 \end{aligned}$$

Domain

$$f(g(x)) = \sqrt{\frac{1}{x+2} - 3}$$

$$\frac{1}{x+2} - 3 = 0$$

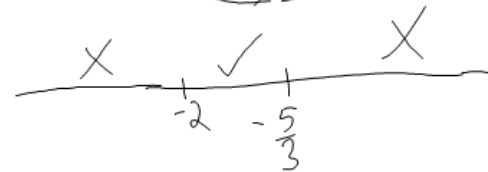
$$\cancel{x+2} \frac{1}{\cancel{x+2}} = 3$$

$$(g \circ f)(x) = g(f(x)) = \frac{1}{\sqrt{x-3} + 2}$$

$$1 = 3x + 6$$

$$-5 = 3x$$

$$\frac{-5}{3} = x$$



$$-2 < x \leq -\frac{5}{3}$$

$$x-3=0$$

$$x=3$$



$$3 \leq x$$

Find Domain of $g(x)$ and $f(x)$

$$g(x) = \sqrt{4x-5}$$

$$f(x) = \frac{4}{x^2-4}$$

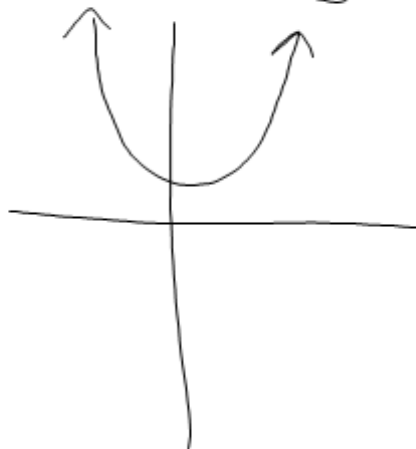
$$f(x) = \sqrt{x-3}$$

$$y = \sqrt{x-3}$$

$$(x)^2 = (\sqrt{y-3})^2$$

$$x^2 = y-3$$

$$f(x) = x^2 + 3$$



$$y = \frac{1}{x+2}$$

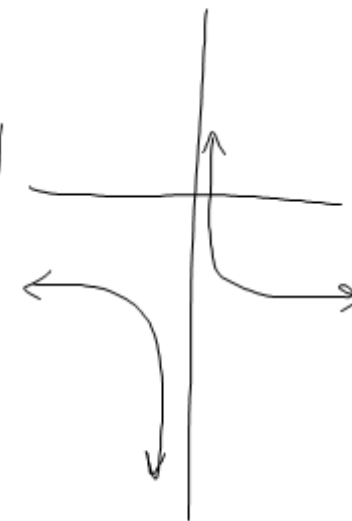
$$(y+2)x = \frac{1}{\cancel{y+2}} \cdot y+2$$

$$xy + 2x = 1$$

$$\quad -2x \quad -2x$$

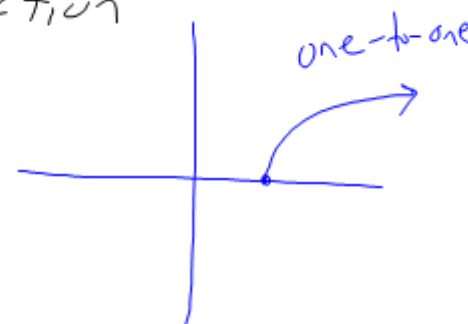
$$\frac{xy}{x} = \frac{1-2x}{x}$$

$$f(x) = \frac{1-2x}{x}$$



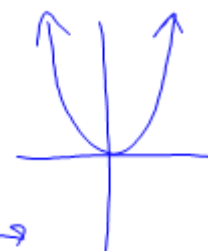
Vertical Line Test

Tells if a relation is a function



Horizontal Line Test

Tells if the inverse is a function



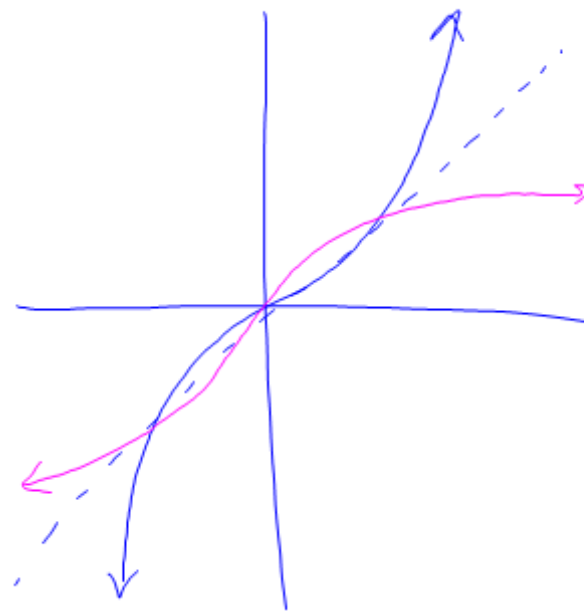
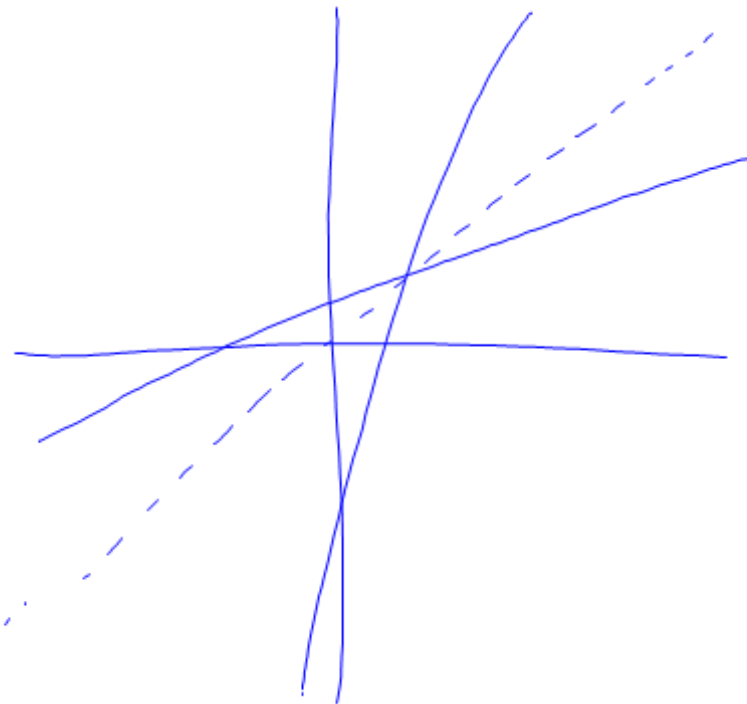
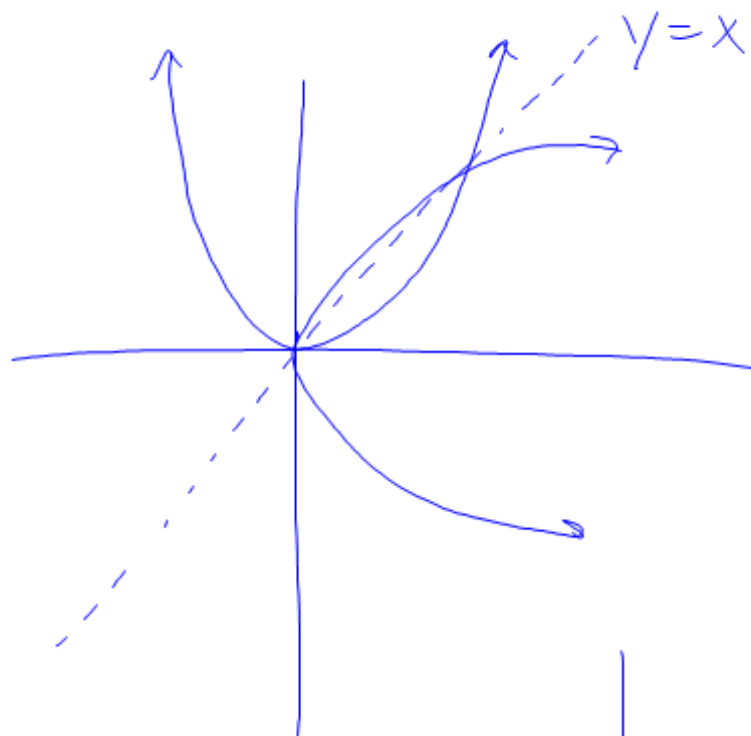
$$y = x^2 \quad x = y^2$$

$$y = \pm \sqrt{x}$$



One-to-one

passes both vertical and horizontal line tests



HW

- Sect. 1.2 #70-73, 83-86

(I want you to seriously try every problem)

- finish 1.6 if you haven't already